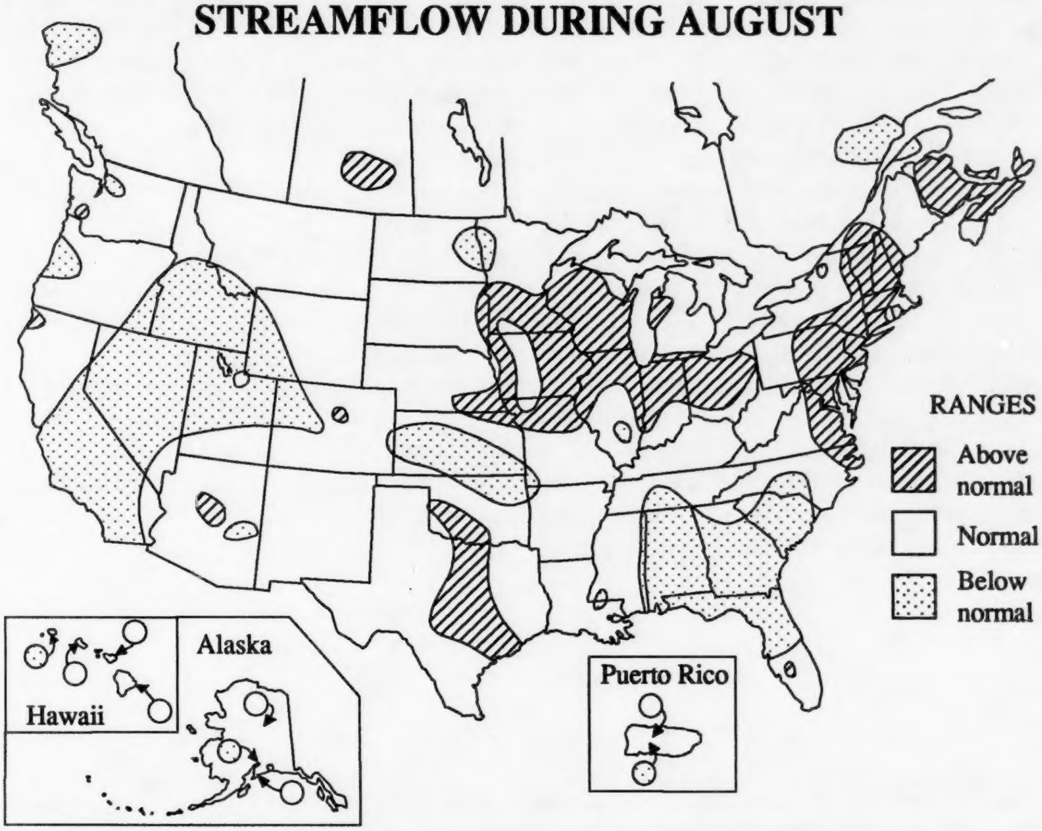
National Water Conditions

UNITED STATES
Department of the Interior
Geological Survey

CANADA
Department of the Environment
Water Resources Branch

AUGUST 1990

STREAMFLOW DURING AUGUST



Heavy rains on August 24-25 caused flooding in the Wapsipinicon and Turkey River basins in northeastern Iowa. Ten counties were declared federal disaster areas because of floods during the month.

Streamflow was in the normal to above-normal range at 77 percent of the index stations in southern Canada, the United States, and Puerto Rico during August, compared with 80 percent of stations in those ranges during July. Below-normal range streamflow occurred in 18 percent of the area of southern Canada and the conterminous United States during August. Total flow for the index stations in the conterminous United States and southern Canada was 18 percent above median despite a 30 percent decrease in streamflow from July to August.

The combined flow of the 3 largest rivers in the lower 48 States--Mississippi, St. Lawrence, and Columbia--averaged 14 percent above median and in the above-normal range during August, but 28 percent less than during July.

Monthend index reservoir contents were in the below-average range at 32 of 100 reporting sites, compared with 36 of 100 during July. Contents were in the above-average range at 35 reservoirs compared with 26 last month).

Mean elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) were in the below-normal range on Lake Superior and in the normal range on Lake Huron, Lake Erie, and Lake Ontario. Levels rose from those for July only on Lake Superior.

Utah's Great Salt Lake fell 0.50 foot to 4,203.00 feet above National Geodetic Vertical Datum of 1929 during August as lake level continued to decline seasonally.

SURFACE-WATER CONDITIONS DURING AUGUST 1990

Heavy rains on August 24-25 caused flooding in the Wapsipinicon and Turkey River basins in northeastern Iowa. Peak discharges were less than those of record and the 100-year flood at streamgaging stations in the area. The most severe flooding took place along the Wapsipinicon River on August 26. Ten counties (Bremer, Buchanan, Chickasaw, Clayton, Fayette, Howard, Johnson, Jones, Linn, and Winneshiek) were declared federal disaster areas because of floods during the month.

Streamflow was in the normal to above-normal range at 77 percent of the index stations in southern Canada, the United States, and Puerto Rico during August, compared with 80 percent of stations in those ranges during July, and 78 percent of stations in those ranges during August 1989. Below-normal range streamflow occurred in 18 percent of the area of southern Canada and the conterminous United States during August (the same as during July) compared with 10 percent during August 1989. The percent area in the below-normal range is again the lowest since January 1990 (11 percent) and very close to the average (since October 1944) of 16 percent. Total August 1990 flow of 1,552,800 cubic feet per second for the index stations in the conterminous United States and southern Canada was 18 percent above median despite a 30 percent decrease in streamflow from July to August, and 20 percent more than flow during August 1989.

Two new monthly highs, one in New Hampshire and one in Iowa, occurred at streamflow index stations during August compared with one low and one high during July. The monthly mean discharge of 3,387 cfs on the Pemigewasset River at Plymouth, New Hampshire (86 years of record), was more than twice the previous August high of 1,599 cfs in 1981 and was 1,030 percent above median. The August 11 maximum daily discharge of 17,500 cfs on the Pemigewasset River also exceeded the previous maximum daily discharge for the month (9,450 cfs in 1981) by 85 percent. On the Cedar River at Cedar Rapids, Iowa (87 years of record), the monthly mean of 17,540 cfs exceeded the previous August high of 13,140 cfs (in 1979) by 33 percent, and the maximum daily discharge of 44,700 cfs on August 2 exceeded the previous August maximum daily discharge (34, 400 cfs in 1979) by 30 percent. Hydrographs for the two stations where new extremes occurred and also for five other stations are on page 5. The three hydrographs below the map are for the Outardes River at Outardes Falls, Que-

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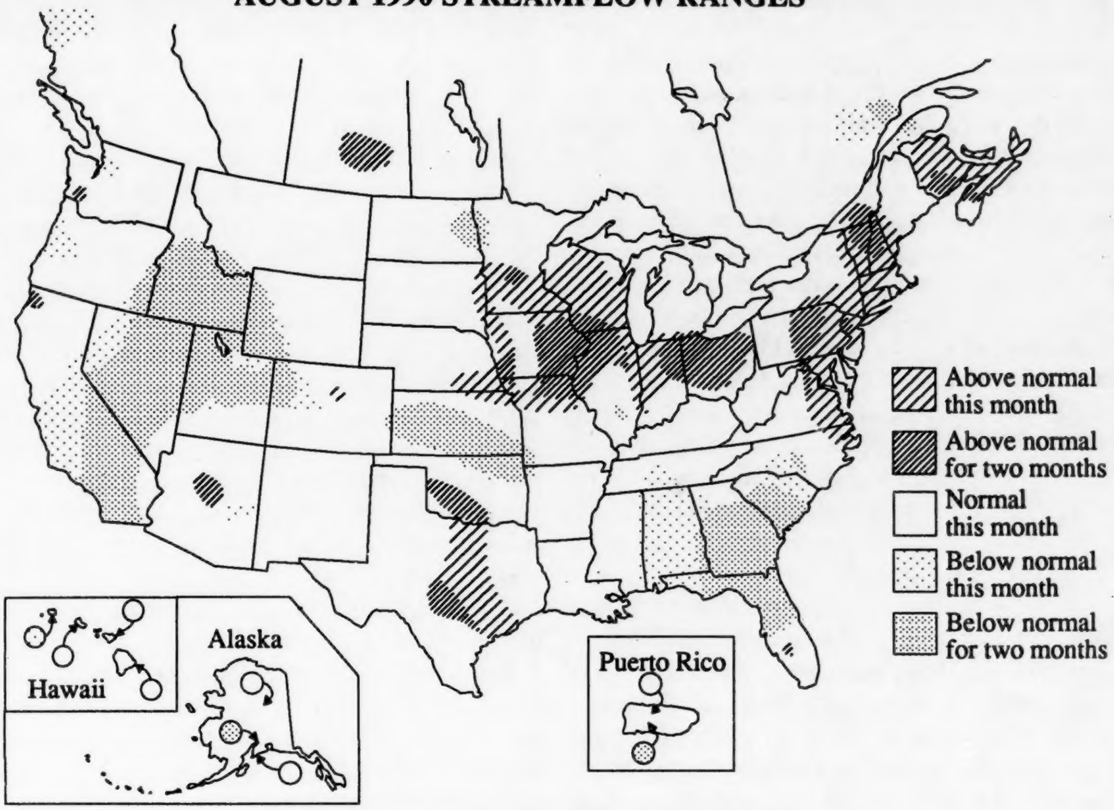
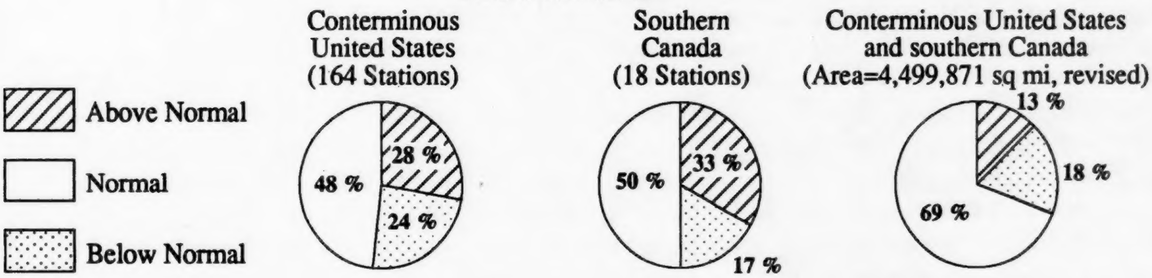
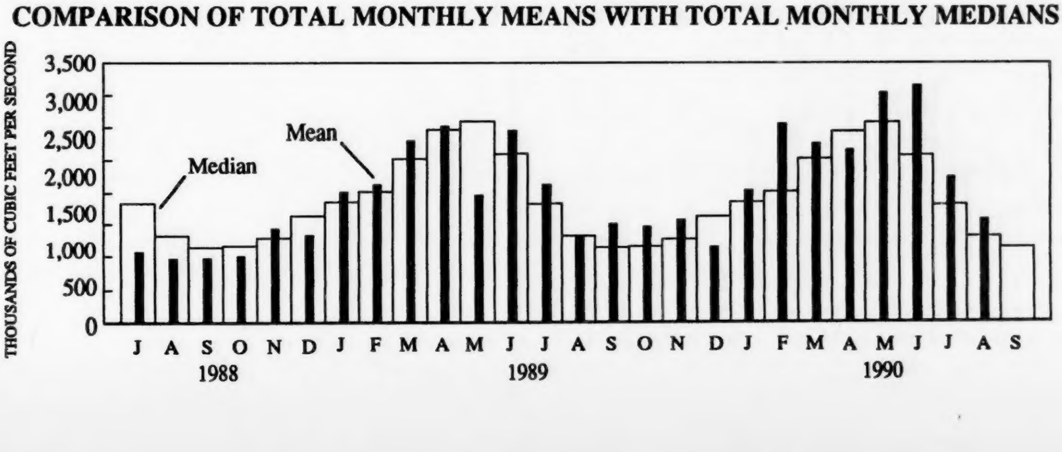
AUGUST 1990 STREAMFLOW RANGES



SUMMARY OF AUGUST 1990 STREAMFLOW
FLOW RANGES



COMPARISON OF TOTAL MONTHLY MEANS WITH TOTAL MONTHLY MEDIANS



bec, where monthly means have been in the below-normal range for four consecutive months and the August mean was 50 percent of median, and two stations where August means were the second lowest of record—Deep River at Moncure, North Carolina (59 years of record), with the monthly mean at13 percent of median, and White River near Meeker, Colorado (37 years of record), with the monthly mean at 52 percent of median—and flows have been in the below normal range for two months and five months, respectively. The two graphs below that for the Cedar River at Cedar Rapids are for: the Mississinewa River at Marion, Indiana (76 years of record), where the August mean was the third highest of record (670 percent above median but 330 cfs below the median for August) and flow has been in the above-normal range for 4 consecutive months; and the Virgin River at Littlefield, Arizona, where flow has been in the normal range for 21 months.

The combined flow of the 3 largest rivers in the lower 48 States—Mississippi, St. Lawrence, and Columbia—averaged 842,200 cfs (14 percent above median and in the above-normal range) during August, but 28 percent less than during July. Flow of the St. Lawrence River was in the normal range for the sixth consecutive month. Flow of the Mississippi River was in the above-normal range for the fourth consecutive month, and flow of the Columbia River was in the normal range for the third consecutive month. Hydrographs for both the combined and individual flows of the "Big 3" are on page 6. Dissolved solids and water temperatures at five large river stations are also given on page 6. Flow data for the "Big 3" and 42 other large rivers are given in the Flow of Large Rivers table on page 7.

Monthend index reservoir contents for August 1990 were in the below-average range (below the monthend average for the period of record by more than 5 percent of normal maximum contents) at 32 of 100 reporting sites, compared with 36 of 100 during July, including most reservoirs in Nebraska, the Dakotas, Wyoming, Idaho, Utah, Nevada, Arizona, and California. Contents were in the above-average range at 35 reservoirs (compared with 26 last month) , including most reservoirs in Nova Scotia, Maine, New Hampshire, New York, New Jersey, Maryland, the Carolinas, and Oklahoma. Reservoirs with contents in the below-average range and significantly lower than last year (with normal maximum contents of at least 1,000,000 acre-feet) were: the Little Tennessee Projects, Tennessee Valley; International Falcon, Texas; Lake McConaughy, Nebraska; Fort Peck, Montana; Boise River (4 reservoirs), Idaho; Bear Lake, Idaho-Utah; Folsom Lake, Clair Engle Lake, Lake Berryessa and Shasta Lake, California; and also the Colorado River Storage Project. Graphs of contents for seven reservoirs are shown on page 8 with contents for the 100 reporting reservoirs given on page 9.

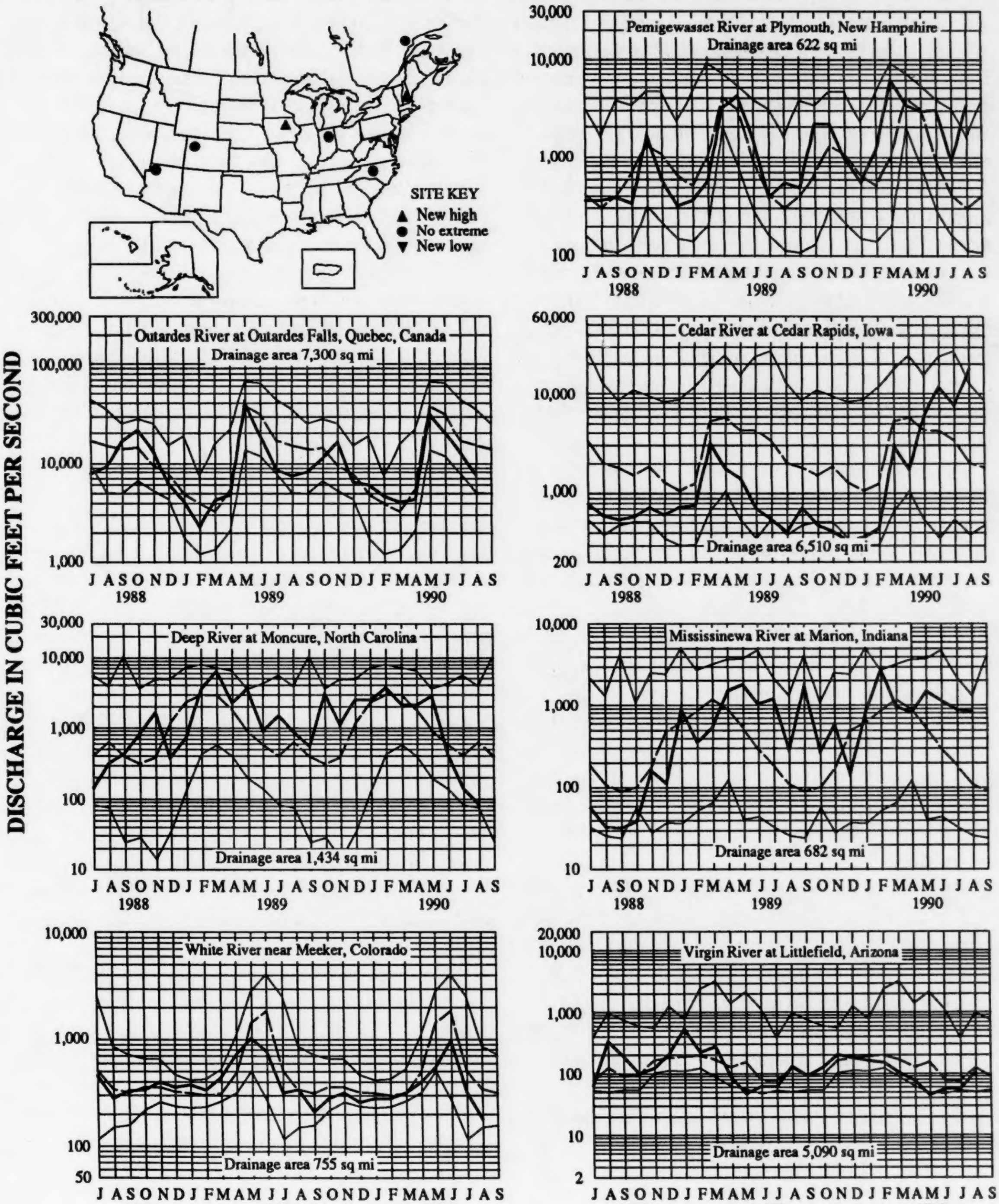
Streamflow conditions during August 1990 and August 1989 are shown by maps on page 10. August 1990 has about 10 percent less area in both the normal and above-normal ranges than August 1989 but almost 80 percent more area in the below-normal range than August 1989. There are only a few areas in which the same non-normal range streamflow occurred during both months. The locations of reservoirs with below-average contents at the end of August 1990 and August 1989 are also shown on the respective maps.

Mean August elevations at the four master gages on the Great Lakes (provisional National Ocean Service data) were in the below-normal range on Lake Superior and in the normal range on Lake Huron, Lake Erie, and Lake Ontario, the same as during June and July. Levels rose from those for July only on Lake Superior, falling from those for July on the other three lakes. August levels ranged from 0.17 foot lower (Lake Ontario) to 0.06 foot higher (Lake Superior) than those for July. Monthly means have now been in the below-normal range for 11 months on Lake Superior. Monthly means have been in the normal range for 3 months on Lake Huron, for 29 months on Lake Erie and for 16 months on Lake Ontario. August 1990 levels ranged from 0.52 foot lower (Lake Ontario) to 0.81 foot higher (Lake Huron) than those for August 1989. Stage hydrographs for the master gages on Lake Superior, Lake Huron, Lake Erie, and Lake Ontario are on page 11.

Utah's Great Salt Lake (graph on page 11) fell 0.50 foot to 4,203.00 feet above National Geodetic Vertical Datum (NGVD) of 1929 during August as lake level continued to decline seasonally after peaking at 4,204.70 feet above NGVD of 1929 in March-April. Lake level is 2.00 feet lower than at the end of August 1989, and 8.85 feet lower than the maximum of record which occurred in June 1986 and March-April 1987. (The July 31 elevation of the Great Salt Lake was revised to 4,203.50 feet above NGVD of 1929 after the *National Water Conditions* went to press.)

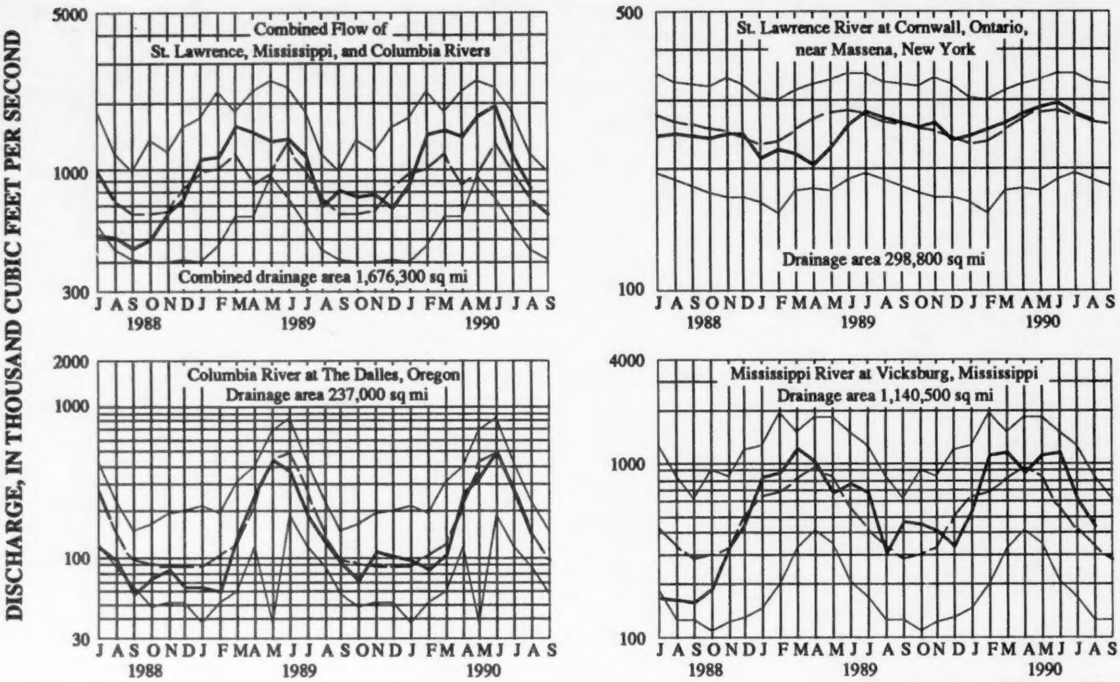
MONTHLY MEAN DISCHARGE OF SELECTED STREAMS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.



HYDROGRAPHS FOR THE BIG THREE RIVERS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period.



Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES, FOR AUGUST 1990, AT DOWNSTREAM SITES ON FIVE LARGE RIVERS

Station number	Station name	July data of following calendar years	Stream discharge during month	Dissolved-solids concentration[a]		Dissolved-solids discharge[a]			Water temperature[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean (tons per day)	Minimum (tons per day)	Maximum (tons per day)	Mean in °C	Minimum in °C	Maximum in °C
01463500	Delaware River at Trenton, New Jersey, (Morrisville, Pennsylvania)	1990	9,090	93	126	2,600	1,360	4,290	24.0	20.0	27.0
		1945-89	5,980	67	158	1,630[d]	505	21,500	25.5[d]	17.5	30.5
		(Extreme yr)		(1945)	(1967)		(1965)	(1955)			
			[c]4,547								
07289000	Mississippi River at Vicksburg, Mississippi	1990	434,000	249	276	305,000	256,000	387,000	29.0	27.5	30.5
		1976-89	357,000	200	345	250,000	114,000	442,000	29.5	26.0	34.0
		(Extreme yr)		(1980)	(1986)		(1988)	(1979)			
			[c]337,900								
03612500	Ohio River at lock and dam 53, near Grand Chain, Illinois, (streamflow station at Metropolis, Illinois)	1990	130,800	180	271	......	36,800	130,000	...	26.0	27.5
		1955-89	129,000	121	339	......	4,490	246,000	...	17.0	30.5
		(Extreme yr)		(1983)	(1977)		(1981)	(1958)			
			[c]121,500								
06934500	Missouri River at Hermann, Missouri. (60 miles west of St. Louis, Missouri)	1990	73,200	228	455	71,100	53,400	97,400	28.0	27.0	29.0
		1976-89	69,000	218	535	76,100	43,000	180,000	27.0	22.0	31.0
		(Extreme yr)		(1981)	(1979)		(1977)	(1982)			
			[c]55,910								
14128910	Columbia River at Warrendale, Oregon (streamflow station at The Dalles, Oregon)	1990	139,000	76	81	29,400	19,900	35,300	22.0	21.0	23.0
		1976-89	132,000	71	100	30,400	14,200	52,500	20.5	18.5	22.0
		(Extreme yr)		(1976)	(1977)		(1978)	(1976)			
			[c]143,550								

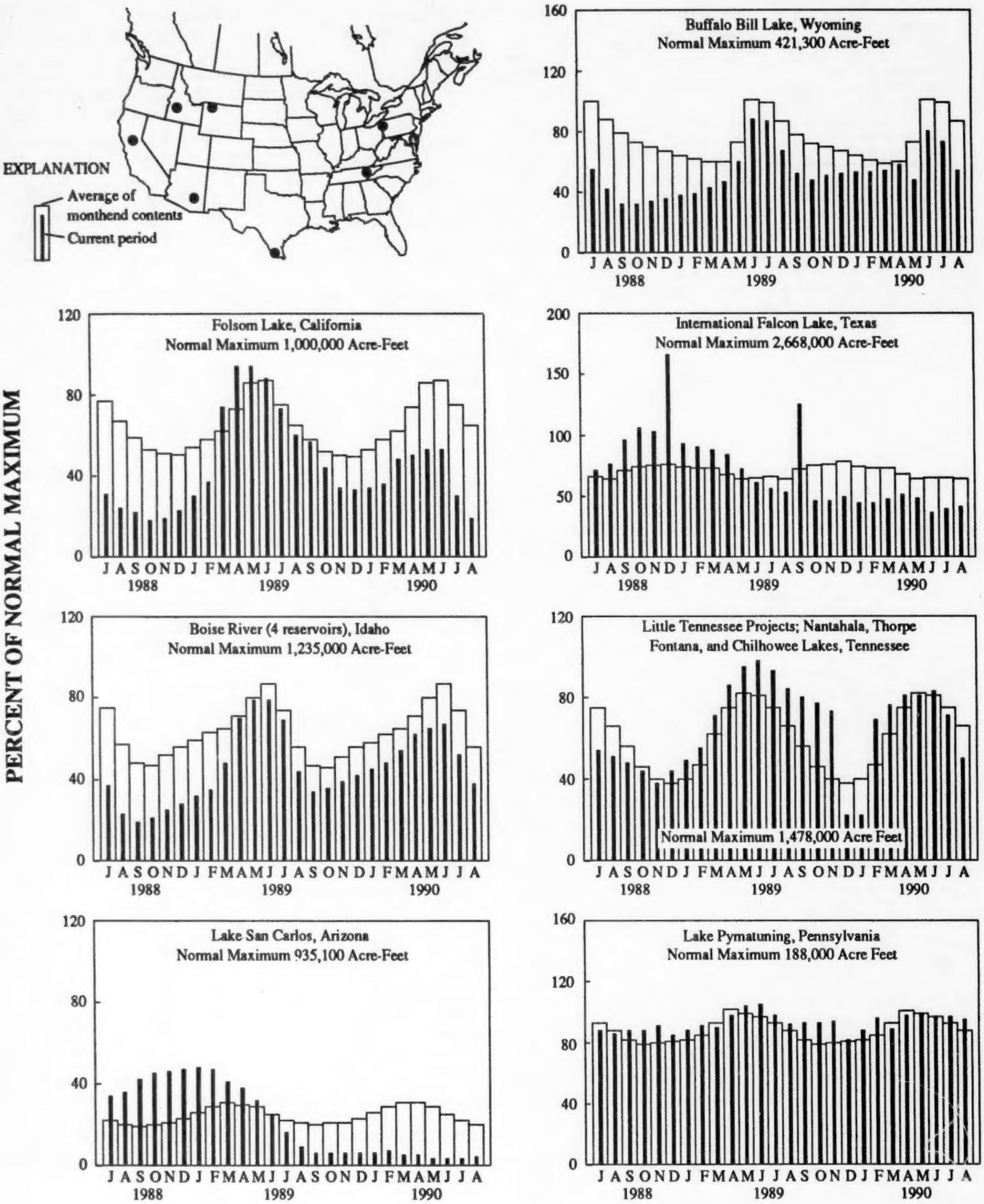
[a]Dissolved -solids concentrations, when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 x °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1951-80, for comparison with data for current month.
[d]Mean for 6-year period (1984-89).

FLOW OF LARGE RIVERS DURING AUGUST 1990

Station number	Stream and place of determination	Drainage area (square miles)	Average discharge through September 1985 (cubic feet per second)	August 1990: Monthly mean discharge (cubic feet per second)	Percent of median monthly discharge 1951–80	Change in discharge from previous month (percent)	Discharge near end of month: Cubic feet per second	Discharge near end of month: Million gallons per day	Date
01014000	St. John River below Fish River at Fort Kent, Maine	5,665	9,758	6,854	166	89	4,760	3,080	31
01318500	Hudson River at Hadley, New York	1,664	2,908	2,480	237	136	1,100	710	31
01357500	Mohawk River at Cohoes, New York	3,456	5,683	1,840	120	27	2,000	1,300	31
01463500	Delaware River at Trenton, New Jersey	6,780	11,670	9,086	200	23	9,630	6,220	31
01570500	Susquehanna River at Harrisburg, Pennsylvania	24,100	34,340	15,300	177	–37	32,600	21,100	26
01646500	Potomac River near Washington, District of Columbia	11,560	[1]11,500	[1]4,880	140	–28	5,600	3,620	31
02105500	Cape Fear River at William O. Huske Lock, near Tarheel, North Carolina.	4,852	5,002	1,396	55	21	......	......	...
02131000	Pee Dee River at Peedee, South Carolina	8,830	9,871	3,729	69	–5	6,900	4,460	31
02226000	Altamaha River at Doctortown, Georgia	13,600	13,730	2,923	49	11	2,460	1,590	30
02320500	Suwannee River at Branford, Florida	7,880	6,986	1,915	35	–13	1,810	1,170	31
02358000	Apalachicola River at Chattahoochee, Florida	17,200	22,420	8,591	64	–11	8,080	5,220	31
02467000	Tombigbee River at Demopolis lock and dam, near Coatopa, Alabama.	15,385	23,520	2,828	59	–41	2,730	1,760	31
02489500	Pearl River near Bogalusa, Louisiana	6,573	9,880	2,823	105	–20	2,530	1,640	31
03049500	Allegheny River at Natrona, Pennsylvania	11,410	[1]19,580	[1]7,040	127	–64	5,300	3,430	26
03085000	Monongahela River at Braddock, Pennsylvania	7,337	[1]12,480	[1]4,220	99	–69	6,000	3,900	26
03193000	Kanawha River at Kanawha Falls, West Virginia	8,367	12,550	5,265	117	–5	5,070	3,280	30
03234500	Scioto River at Higby, Ohio	5,131	4,583	3,047	247	–69	1,860	1,200	31
03294500	Ohio River at Louisville, Kentucky[2]	91,170	115,800	65,260	178	–47	67,000	43,300	28
03377500	Wabash River at Mount Carmel, Illinois	28,635	27,660	20,990	231	–19	25,200	16,300	31
03469000	French Broad River below Douglas Dam, Tennessee[3]	4,543	[1]6,739	[1]2,805	87	–9	......	......	......
04084500	Fox River at Rapide Croche Dam, near Wrightstown, Wisconsin.[2]	6,010	4,238	4,433	206	33	5,880	3,800	31
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, New York.[4]	298,800	243,900	267,000	101	–4	266,000	172,000	31
02NG001	St. Maurice River at Grand Mere, Quebec	16,300	24,910	9,800	59	–43	13,600	8,790	31
05082500	Red River of the North at Grand Forks, North Dakota	30,100	2,593	452	39	–52	480	310	31
05133500	Rainy River at Manitou Rapids, Minnesota	19,400	12,920	9,070	90	–58	28	18	...
05330000	Minnesota River near Jordan, Minnesota	16,200	3,680	6,398	492	1	5,000	3,200	31
05331000	Mississippi River at St. Paul, Minnesota	36,800	[1]11,020	12,430	170	–20	10,800	6,980	31
05365500	Chippewa River at Chippewa Falls, Wisconsin	5,650	5,149	4,740	164	86	4,100	2,650	31
05407000	Wisconsin River at Muscoda, Wisconsin	10,400	8,710	9,844	187	34	16,000	10,300	31
05446500	Rock River near Joslin, Illinois	9,549	6,080	7,380	230	–35	9,080	5,870	31
05474500	Mississippi River at Keokuk, Iowa	119,000	63,790	100,500	251	–8	146,000	94,400	31
06214500	Yellowstone River at Billings, Montana	11,795	7,056	4,960	91	–59	4,150	2,680	31
06934500	Missouri River at Hermann, Missouri	524,200	80,880	73,150	131	–18	53,400	34,500	31
07289000	Mississippi River at Vicksburg, Mississippi[5]	1,140,500	584,000	434,000	128	–31	380,000	246,000	27
07331000	Washita River near Dickson, Oklahoma	7,202	1,402	780	239	–59	540	349	28
08276500	Rio Grande below Taos Junction Bridge, near Taos, New Mexico.	9,730	742	364	126	–17	310	200	31
09315000	Green River at Green River, Utah	44,850	6,391	1,179	37	–55	......	......	...
11425500	Sacramento River at Verona, California	21,251	19,430	12,580	118	39	......	......	...
13269000	Snake River at Weiser, Idaho	69,200	18,520	8,810	80	14	11,000	7,100	31
13317000	Salmon River at White Bird, Idaho	13,550	11,390	4,610	80	–42	4,710	3,040	31
13342500	Clearwater River at Spalding, Idaho	9,570	15,510	4,090	108	–48	4,100	2,650	31
14105700	Columbia River at The Dalles, Oregon[6]	237,000	[1]193,500	[1]141,200	98	–48	126,000	81,400	31
14191000	Willamette River at Salem, Oregon	7,280	[1]23,690	[1]3,196	79	–36	7,200	4,652	31
15515500	Tanana River at Nenana, Alaska	25,600	23,810	61,640	112	–1	75,000	48,500	31
08MF005	Fraser River at Hope, British Columbia	83,800	96,250	117,900	94	–47	77,000	49,800	31

[1]Adjusted.
[2]Records furnished by Corps of Engineers.
[3]Records furnished by Tennessee Valley Authority.
[4]Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y., when adjusted for storage in Lake St. Lawrence.
[5]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[6]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS



Provisional data; subject to revision

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF AUGUST 1990

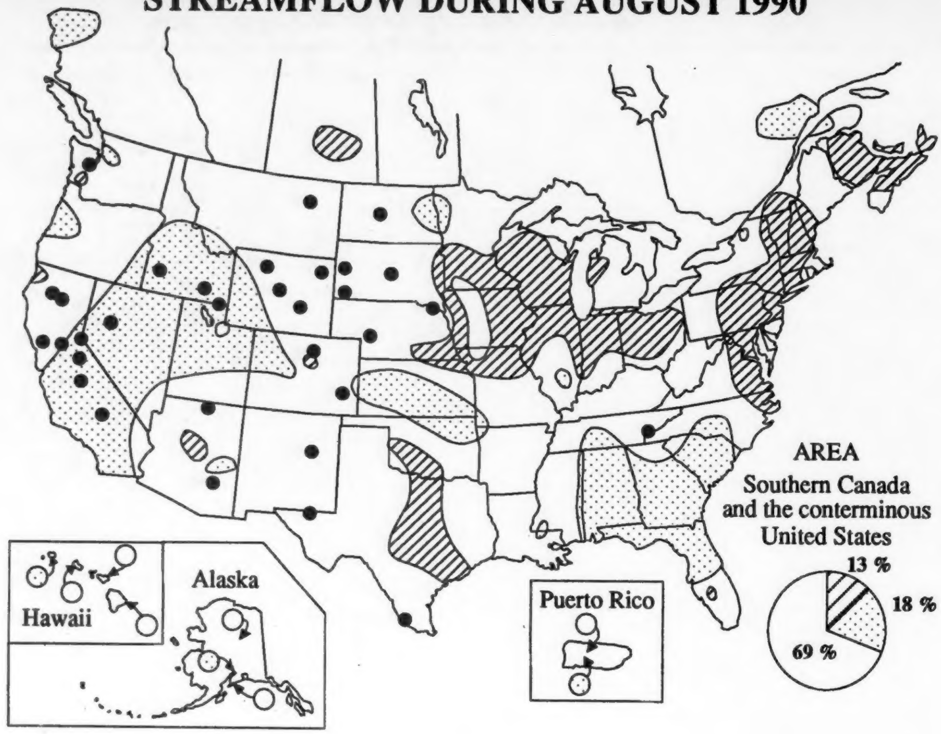
[Contents are expressed in percent of reservoir (system) capacity. The usable storage capacity of each reservoir (system) is shown in the column headed "Normal maximum"]

Reservoir Principal uses: F-Flood control I-Irrigation M-Municipal P-Power R-Recreation W-Industrial	Percent of normal maximum				
	End of August 1990	End of August 1989	Average for end of August	End of July 1990	Normal maximum (acre-feet)[a]
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P).....	60	57	49	71	[b]226,300
QUEBEC					
Allard (P)	81	79	69	88	280,600
Gouin (P)	69	60	69	69	6,954,000
MAINE					
Seven Reservoir Systems (MP)............	79	74	68	87	4,107,000
NEW HAMPSHIRE					
First Connecticut Lake (P)..................	85	83	83	87	76,450
Lake Francis (FPR)..........................	95	79	81	89	99,310
Lake Winnipesaukee (PR)..................	93	80	75	92	165,700
VERMONT					
Harriman (P)	72	76	70	74	116,200
Somerset (P)...................................	85	79	75	86	57,390
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP).......................	87	90	77	87	77,920
NEW YORK					
Great Sacandaga Lake (FPR)..............	82	80	71	84	786,700
Indian Lake (FMP)	91	90	73	93	103,300
New York City Reservoir System (MW) .	86	85	82	88	1,680,000
NEW JERSEY					
Wanaque (M)...................................	84	83	74	85	85,100
PENNSYLVANIA					
Allegheny (FPR)...............................	46	43	43	49	1,180,000
Pymatuning (FMR)............................	95	92	88	97	188,000
Raystown Lake (FR)..........................	67	67	63	67	761,900
Lake Wallenpaupack (PR)..................	69	67	64	70	157,800
MARYLAND					
Baltimore Municipal System (M)	95	95	87	96	261,900
NORTH CAROLINA					
Bridgewater (Lake James) (P).............	97	97	88	96	288,800
Narrows (Badin Lake) (P)..................	96	95	97	96	128,900
High Rock Lake (P)	91	89	74	82	234,800
SOUTH CAROLINA					
Lake Murray (P)	80	86	74	86	1,614,000
Lakes Marion and Moultrie (P)............	80	85	70	76	1,862,000
SOUTH CAROLINA-GEORGIA					
Strom Thurmond Lake (FP)................	60	75	65	66	1,730,000
GEORGIA					
Burton (PR)	97	98	88	99	104,000
Sinclair (MPR)	89	91	86	89	214,000
Lake Sidney Lanier (FMPR)	51	63	56	58	1,686,000
ALABAMA					
Lake Martin (P)	92	96	86	96	1,375,000
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	57	66	46	66	2,293,000
Douglas Lake (FPR)........................	45	70	46	74	1,395,000
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	71	86	68	83	1,012,000
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)...............	61	76	54	75	2,880,000
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)................................	50	84	66	71	1,478,000
WISCONSIN					
Chippewa and Flambeau (PR)............	84	75	76	90	365,000
Wisconsin River (21 Reservoirs) (PR)....	75	55	63	74	399,000
MINNESOTA					
Mississippi River Headwater System (FMR)..............................	37	36	34	39	1,640,000
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR).......	60	62	90	62	22,700,000
SOUTH DAKOTA					
Angostura (I)..................................	42	36	72	48	130,770
Belle Fourche (I).............................	16	13	38	34	185,200
Lake Francis Case (FIP)...................	79	80	81	78	4,589,000
Lake Oahe (FIP)	59	58	68	61	22,240,000
Lake Sharpe (FIP)...........................	99	100	101	101	1,697,000
Lewis and Clark Lake (FIP)...............	96	88	104	81	432,000
NEBRASKA					
Lake McConaughy (IP)	47	56	68	53	1,948,000
OKLAHOMA					
Eufaula (FPR)..................................	95	99	84	96	2,378,000
Keystone (FPR)................................	83	92	88	86	661,000
Tenkiller Ferry (FPR)	102	104	92	103	628,200
Lake Altus (FIMR)............................	64	72	48	72	133,000
Lake O'The Cherokees (FPR).............	91	94	84	98	1,492,000
OKLAHOMA-TEXAS					
Lake Texoma (FMPRW).....................	94	92	91	101	2,722,000
TEXAS					
Bridgeport (IMW).............................	95	100	50	99	386,400
Canyon (FMR)	96	90	79	97	385,600
International Amistad (FIMPW)..........	79	84	80	59	3,497,000
International Falcon (FIMPW)	41	53	64	39	2,668,000
Livingston (IMW).............................	99	100	88	100	1,788,000
Possum Kingdom (IMPRW)...............	94	93	96	93	570,200
Red Bluff (P)...................................	18	31	24	19	307,000
Toledo Bend (P)..............................	84	93	85	92	4,472,000
Twin Buttes (FIM)............................	38	55	31	41	177,800
Lake Kemp (IMW)............................	98	92	82	98	268,000
Lake Meredith (FMW)......................	34	41	38	34	796,900
Lake Travis (FIMPRW).....................	85	70	75	87	1,144,000
MONTANA					
Canyon Ferry (FIMPR).....................	82	70	85	87	2,043,000
Fort Peck (FPR)..............................	60	66	88	61	18,910,000
Hungry Horse (FIPR).......................	99	75	93	99	3,451,000
WASHINGTON					
Ross (PR).......................................	99	96	94	100	1,052,000
Franklin D. Roosevelt Lake (IP)..........	97	98	102	102	5,022,000
Lake Chelan (PR)	97	98	98	99	676,100
Lake Cushman (PR)	36	73	96	37	359,500
Lake Merwin (P)..............................	107	102	102	105	245,600
IDAHO					
Boise River (4 Reservoirs) (FIP)	38	44	56	52	1,235,000
Coeur d'Alene Lake (P).....................	94	97	76	95	238,500
Pend Oreille Lake (FP)	99	100	99	98	1,561,000
IDAHO-WYOMING					
Upper Snake River (8 Reservoirs) (MP)	34	49	55	52	4,401,000
WYOMING					
Boysen (FIP)....................................	74	83	86	75	802,000
Buffalo Bill (IP)...............................	54	67	87	73	421,300
Keyhole (F).....................................	17	21	44	20	193,800
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)..	33	36	51	40	3,056,000
COLORADO					
John Martin (FIR)............................	8	10	20	11	364,400
Taylor Park (IR)...............................	84	90	79	92	106,200
Colorado-Big Thompson Project (I)......	51	49	64	55	730,300
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)...........	69	81	79	72	31,620,000
UTAH-IDAHO					
Bear Lake (IPR)...............................	40	52	64	45	1,421,000
CALIFORNIA					
Folsom (FIP)...................................	19	60	65	30	1,000,000
Hetch Hetchy (MP)...........................	53	79	70	63	360,400
Isabella (FIR)..................................	9	18	35	3	568,100
Pine Flat (FI)	2	3	40	9	1,001,000
Clair Engle Lake (Lewiston) (P)	55	64	78	61	2,438,000
Lake Almanor (P)	79	79	60	83	1,036,000
Lake Berryessa (FIMW)	41	52	78	44	1,600,000
Millerton Lake (FI)..........................	40	28	43	55	503,200
Shasta Lake (FIPR)..........................	40	48	68	48	4,377,000
CALIFORNIA-NEVADA					
Lake Tahoe (IPR)	3	15	61	9	744,600
NEVADA					
Rye Patch (I)...................................	3	15	60	6	194,300
ARIZONA-NEVADA					
Lake Mead and Lake Mohave (FIMP)....	77	81	75	77	27,970,000
ARIZONA					
San Carlos (IP)................................	4	9	20	3	935,100
Salt and Verde River System (IMPR)	39	55	43	40	2,019,100
NEW MEXICO					
Conchas (FIR).................................	62	68	87	54	315,700
Elephant Butte and Caballo (FIPR).......	59	71	38	61	2,233,300

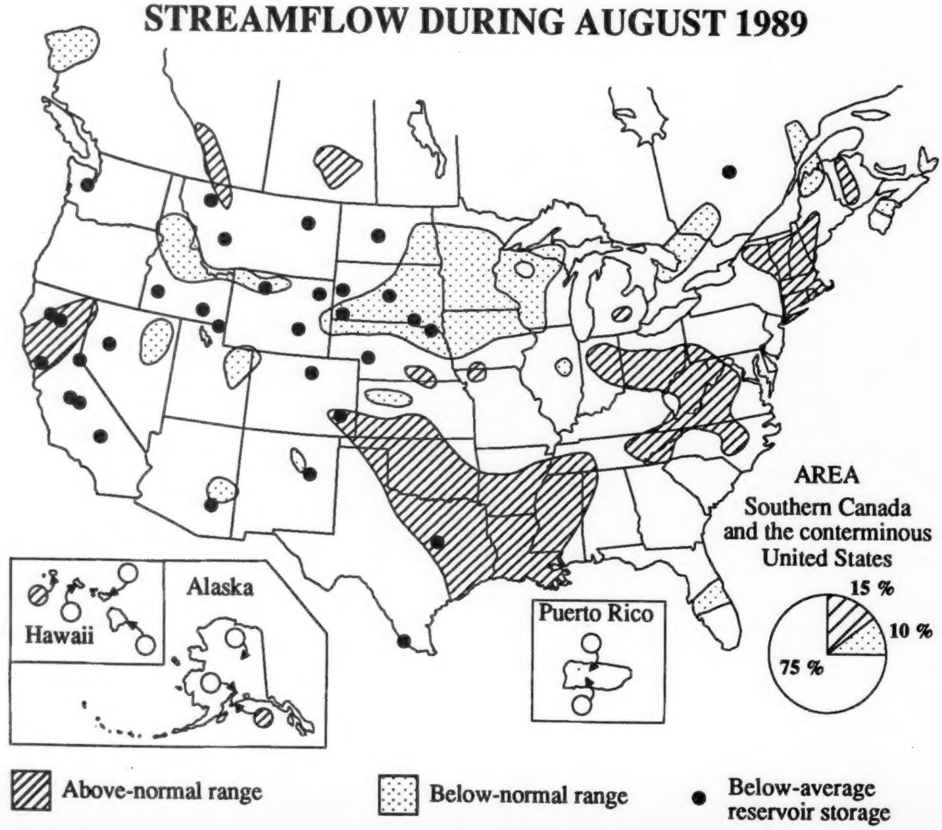
[a] 1 acre-foot = 0.04356 million cubic feet = 0.326 million gallons = 0.504 cubic feet per second per day.

[b] Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

STREAMFLOW DURING AUGUST 1990

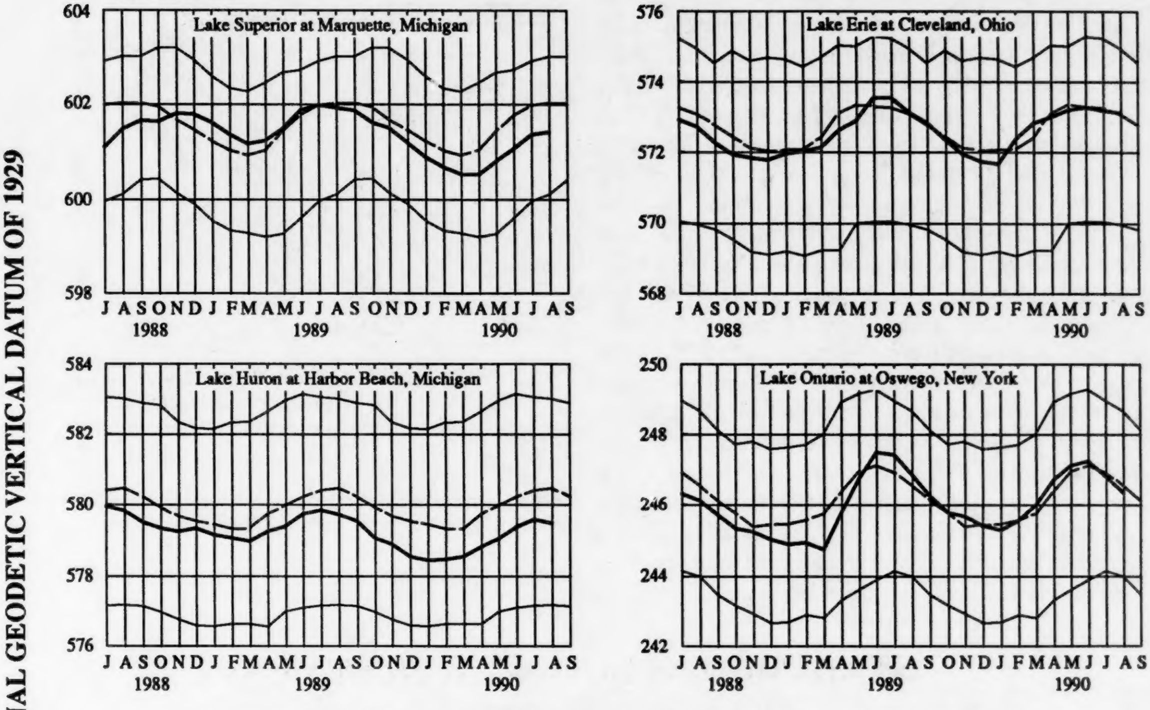


STREAMFLOW DURING AUGUST 1989

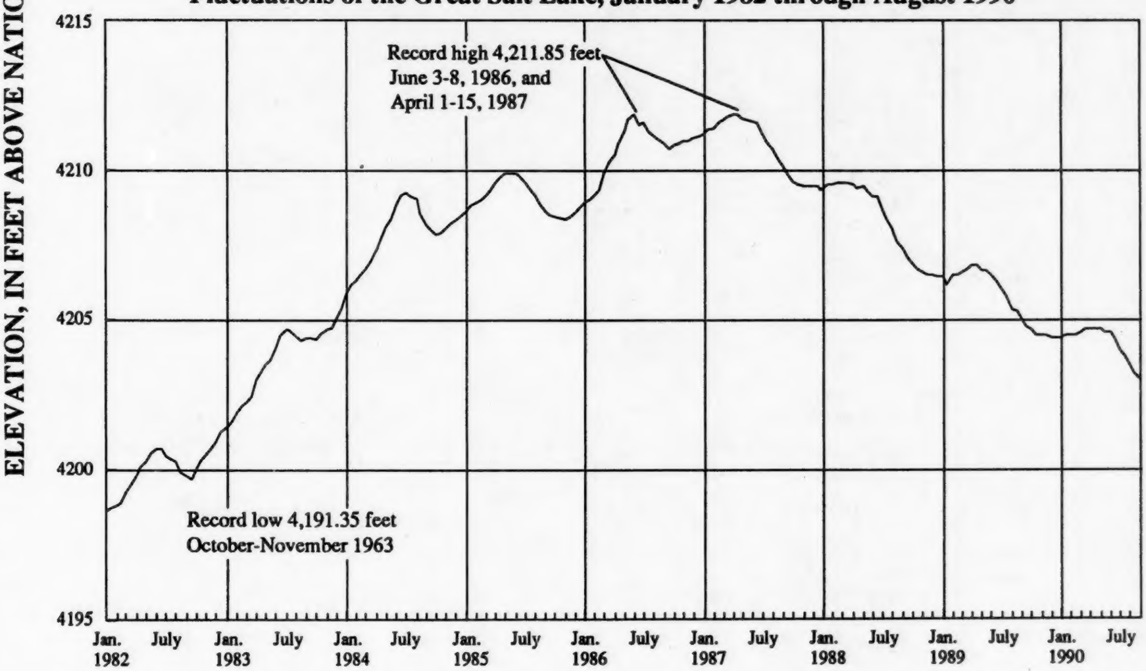


GREAT LAKES ELEVATIONS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates median of monthly values for reference period, 1951-80. Heavy line indicates mean for current period. Data from National Ocean Service.



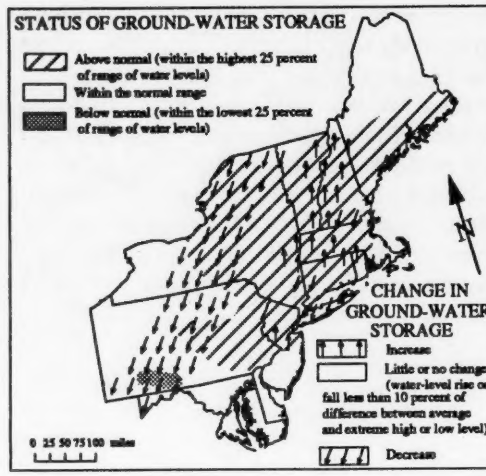
Fluctuations of the Great Salt Lake, January 1982 through August 1990



GROUND-WATER CONDITIONS DURING AUGUST 1990

Ground-water levels continue to be above average in the central part of the Northeast Region. (See map). Below average levels persist in a small area in south-central Pennsylvania. Water levels fell in much of the western part of the Region and a few small areas in New England including parts of Pennsylvania, New York, Connecticut, Massachusetts, and New Hampshire. Levels rose throughout much of New England and a small part of New Jersey and New York.

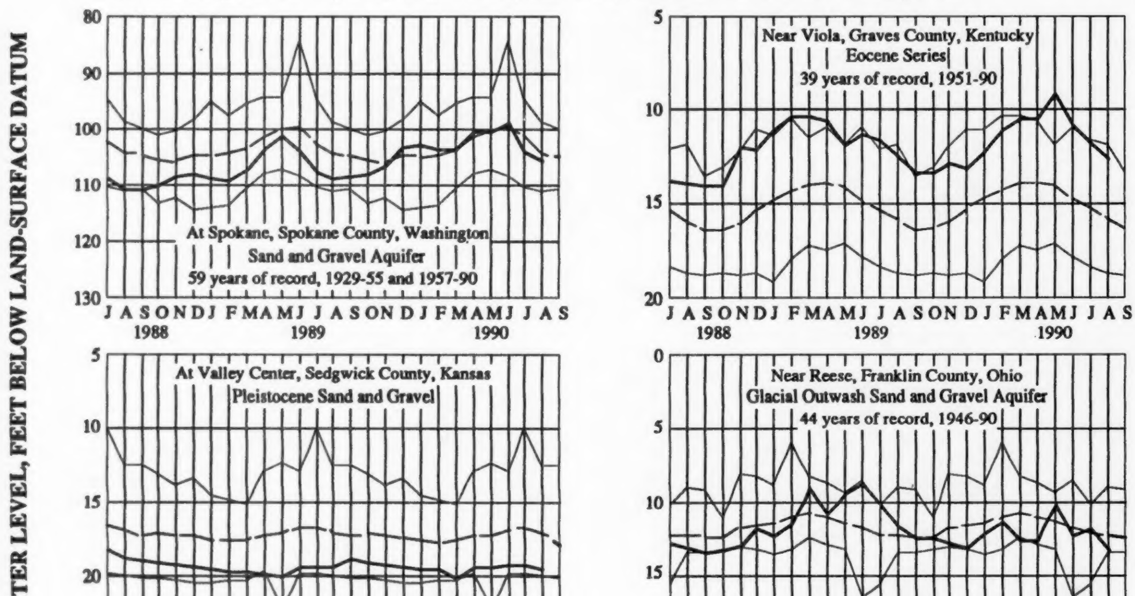
In the Southeastern States, ground-water levels declined throughout most of West Virginia, Kentucky, North Carolina, and Mississippi. Elsewhere, levels were mixed with respect to last month's levels. Levels were above long-term averages in most of the northern parts of the Southeast including West Virginia, Kentucky, and Virginia and below average in most of the southern part of the Southeast including Arkansas, Louisiana, and Florida. In Georgia, levels were mixed with respect to average. A record August low occurred in the key well in the Conemaugh Formation at Glenville, Gilmer County, West Virginia, and an all-time low occurred in the key well in the Sparta Sand aquifer at Ruston, Jackson Parish, Louisiana (36 years of record).



Map showing ground-water storage near end of August and change in ground-water storage from end of July to end of August.

MONTHEND GROUND-WATER LEVELS IN KEY WELLS

Area between light-weight solid lines indicates range between highest and lowest record for the month. Dashed line indicates average of monthly levels in previous years. Heavy line indicates level for current period.



In the central and western Great Lakes States, ground-water levels rose in Wisconsin, fell in Michigan and Ohio, and elsewhere were mixed with respect to last month's levels. Above average water levels occurred in most of Iowa while below average levels occurred in most of Minnesota and Wisconsin. Levels were mixed with respect to long-term averages in Michigan and Ohio.

In the Western States, ground-water levels generally fell in Washington, North Dakota, Nebraska, southern California, Nevada, Utah, Kansas, and Texas. Levels generally rose in Idaho and New Mexico. Water levels were below long-term averages throughout most of the west. Despite rises in levels since last month, August lows occurred in key wells in the south-central Snake River Plain aquifer at Rupert, Minidoka County, Idaho; in Quarternary alluvium in Las Vegas Valley, Clark County, Nevada; and in the Hueco Bolson aquifer at El Paso, Texas. An August high occurred in a key well in the San Andreas Limestone at Berrendo-Smith, Chaves County, New Mexico. Levels fell to all-time lows in wells in the Sentinel Butte Formation at Dickinson, Starke County, North Dakota (22 years of record); in Quarternary alluvium at Baldwin Park, Los Angeles County, California (58 years of record); in Valley Fill aquifers at Holladay, Salt Lake County, and Logan, Cache County, Utah (11 and 50 years of record, respectively); and in the Equus Beds at Halstead, Harvey County, and the Ogallala Formation at Colby, Thomas County, Kansas (50 and 43 years of record, respectively).

Provisional data; subject to revision

WATER LEVELS IN KEY OBSERVATION WELLS IN SOME REPRESENTATIVE AQUIFERS IN THE CONTERMINOUS UNITED STATES–AUGUST 1990

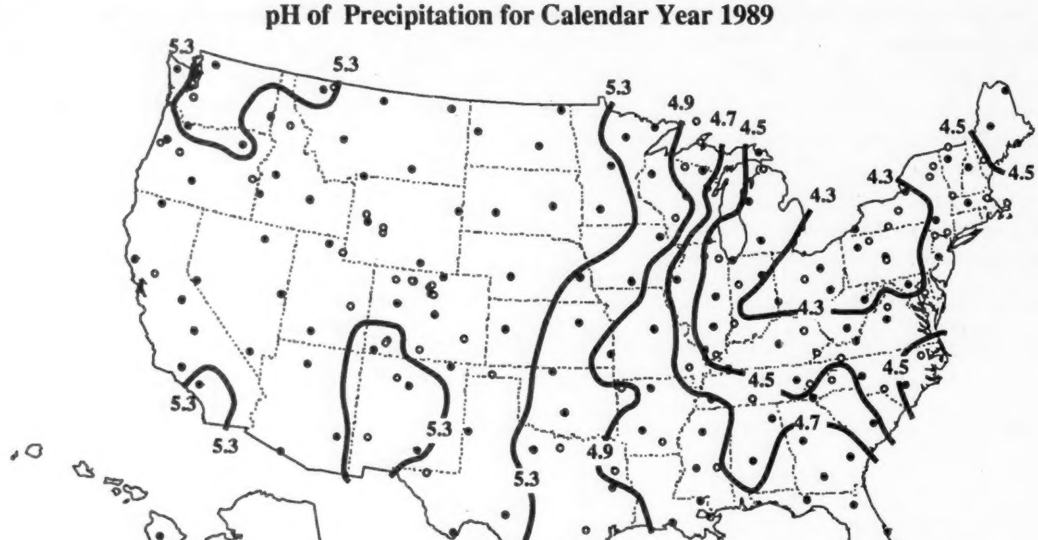
Aquifer and Location	Water level in feet with reference to land–surface datum	Departure from average in feet	Net change in water level in feet since: Last month	Last year	Year records began	Remarks
Glacial drift at Hanska, south–central Minnesota.....	–1.50	+6.00	+3.12	+8.70	1942	All-time high
Glacial drift at Roscommon in north–central part of Lower Peninsula, Michigan.	–5.20	–0.22	–0.26	–0.10	1935	
Glacial drift at Marion, Iowa..............................	–1.81	+4.35	+1.78	+6.13	1941	Aug. high
Glacial drift at Princeton in northwestern Illinois.....	–5.25	+7.86	+0.60	+5.70	1943	
Petersburg Granite, southeastern Piedmont near Fall Zone, Colonial Heights, Virginia.	–13.94	+1.91	+0.99	+1.48	1939	
Glacial outwash sand and gravel, Louisville, Kentucky (U.S. well no. 2).	–17.55	+6.82	–0.04	+1.20	1946	
500–foot sand aquifer near Memphis, Tennessee (U.S. well no. 2).	–108.06	–16.85	–0.60	–0.99	1941	
Weathered granite, Mocksville area, Davie County, western Piedmont, North Carolina.	–16.94	+3.30	–0.72	+0.19	1932	
Sparta Sand in Pine Bluff industrial area, Arkansas..	–238.25	–27.64	+0.65	–1.45	1958	
Eutaw Formation in the City of Montgomery, Alabama (U.S. well no. 4).	–26.7	–2.5	–1.1	+0.6	1952	
Upper Floridan aquifer on Cockspur Island, Savannah area, Georgia (U.S. well no. 6).	–39.89	–11.04	+0.37	–1.59	1956	Aug. low
Sand and gravel in Puget Trough, Tacoma, Washington.	–116.36	–4.53	–1.38	+1.00	1952	
Pleistocene glacial outwash gravel, North Pole, northern Idaho (U.S. well no. 3).	–460.8	–2.0	+0.8	+5.0	1929	
Snake River Group: Snake River Plain Aquifer, at Eden, Idaho (U.S. well no. 4).	–118.5	–2.1	+1.8	+1.3	1957	
Alluvial valley fill in Flowell area, Millard County, Utah (U.S. well no. 9).	–43.26	–3.59	–0.31	–7.44	1929	
Alluvial sand and gravel, Platte River Valley, Ashland, Nebraska (U.S. well no. 6).	......	......	......	......	1935	
Alluvial valley fill in Steptoe Valley, Nevada	–9.11	+3.69	–0.45	–0.54	1950	
Pleistocene terrace deposits in Kansas River valley, at Lawrence, northeastern Kansas.	–21.46	–0.42	–0.31	+3.40	1953	
Alluvium and Paso Robles clay, sand, and gravel, Santa Maria Valley, California.	–155.00	–15.37	–2.00	–9.00	1957	
Valley fill, Elfrida area, Douglas, Arizona (U.S. well no. 15).	–101.26	–17.85	–0.34	–1.48	1951	
Hueco bolson, El Paso area, Texas........................	–271.88	–19.05	+0.07	–0.62	1965	Aug. low
Evangeline aquifer, Houston area, Texas................	–308.52	–4.68	–3.01	–13.28	1965	

pH of Precipitation for July 23 - August 22, 1990

Provisional NADP/NTN data; subject to revision

Current pH data shown on the map (• 4.9) are precipitation-weighted means calculated from preliminary laboratory results provided by the NADP/NTN Central Analytical Laboratory at the Illinois State Water Survey and are subject to change. The 127 points (•) shown on this map represent a subset of all sites (shown below) chosen to provide relatively even geographic spacing. Absence of a pH value at a site indicates no valid sample.

pH of Precipitation for Calendar Year 1989



Isolines of precipitation-weighted mean pH of wet deposition for 1989. Circles on the map represent the approximately 200 active sites of the National Atmospheric Deposition Program/National Trends Network (NADP/NTN). Filled circles represent a subset of 127 sites selected for displaying monthly precipitation-weighted pH means as shown above.

PRECIPITATION pH DATA FROM THE NATIONAL ATMOSPHERIC DEPOSITION PROGRAM/NATIONAL TRENDS NETWORK (NADP/NTN)

Beginning with this issue, the ***National Water Conditions*** will publish monthly precipitation-weighted mean pH values from a subset of sites in the NADP/NTN precipitation chemistry monitoring network (top map, facing page). The NADP/NTN is a 200-station, rural network designed to characterize spatial patterns and temporal trends in precipitation chemistry and wet deposition on a national scale. The first sites in the network were established in 1978. Funding for the program is provided by Federal, State, and private sponsors. The lead Federal agencies are the Cooperative State Research Service of the United States Department of Agriculture, and the United States Geological Survey. Additional Federal support is provided by the United States Forest Service, Bureau of Land Management, National Park Service, National Oceanographic and Atmospheric Administration, United States Environmental Protection Agency, and the Tennessee Valley Authority. Coordination of the NADP/NTN Program is provided at Colorado State University.

Standardized equipment, siting requirements, sampling protocols, analytical methods, and data validation criteria have been established for the network in order to ensure data comparability. Weekly cumulative precipitation samples are collected in a sampling container which is exposed to the atmosphere only during precipitation events. Each Tuesday, the container holding the precipitation sample is removed from the collector, pH and conductivity are determined in the field using a portion of the sample, and the remaining sample is mailed to the network's Central Analytical Laboratory at the Illinois State Water Survey, Champaign, Illinois. The laboratory measures concentrations of SO_4^{-2}, NO_3^-, Cl^-, PO_4^{-3}, Na^+, K^+, Ca^{+2}, Mg^{+2}, and NH_4^+, and also specific conductance and pH. Values of pH shown on maps are those determined in the laboratory. Precipitation amounts are independently measured using a recording rain gage.

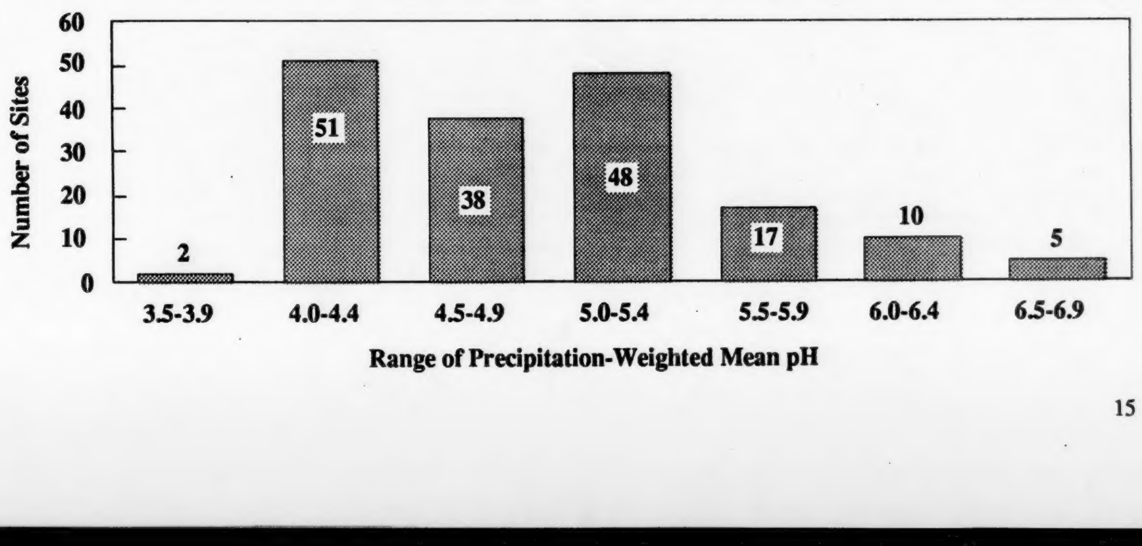
The monthly precipitation-weighted mean pH values reported in the ***National Water Conditions*** are calculated from preliminary laboratory results, and may not include all measurements for the month. The precipitation-weighted mean is calculated by weighting individual sample concentrations by the measured precipitation from the rain gage. Because the reported means are based on preliminary data which may be incomplete and have not been subjected to complete quality review, these values are provisional. In lieu of the standard quality review, individual pH values which are less than the 5th percentile value or greater than the 95th percentile value over the history of a given site are excluded from the calculations to ensure that the mean is not influenced by extreme values of undetermined quality.

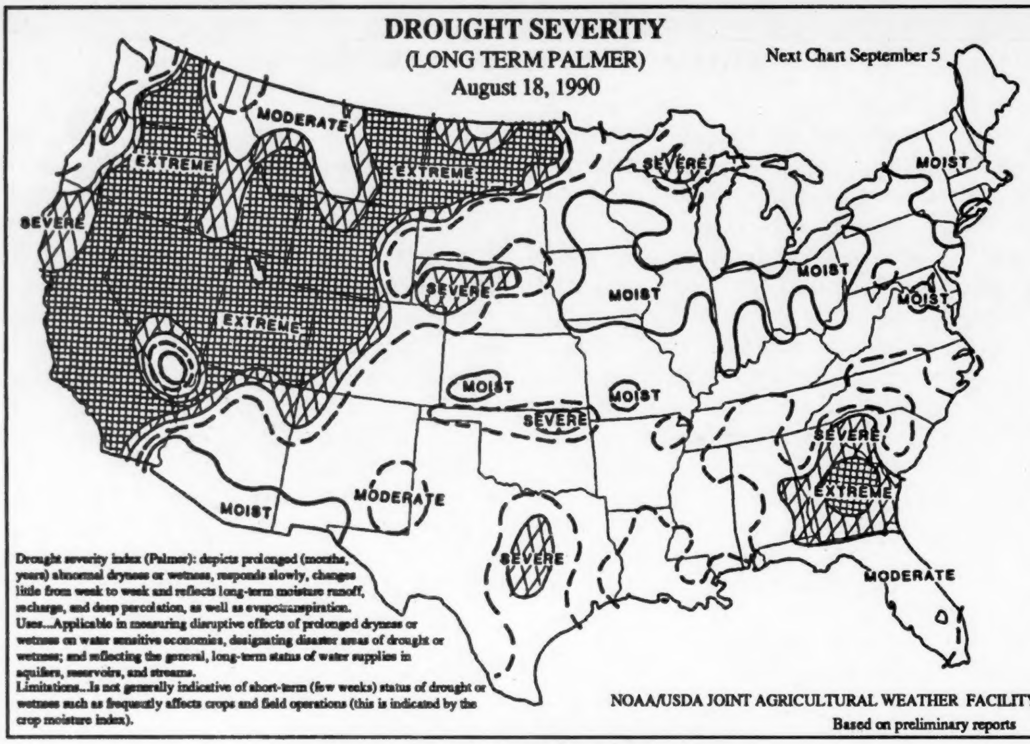
Quality-assured, final weekly data are available approximately 6 months following the date of sample collection. Weekly data, as well as annual, quarterly, and monthly summaries are available for all sites in the network as standardized computer data products (tapes or PC diskettes). Annually, a data summary is published containing weekly data and annual summary statistics for each site, as well as national isoline maps (bottom map, facing page) showing geographical patterns for pH, ion concentrations and deposition.

Program information and data are available from:

NADP/NTN Coordination Office
Natural Resource Ecology Laboratory
Colorado State University
Fort Collins, Colorado 80523

Distribution of precipitation-weighted mean pH for all NADP/NTN sites having one or more weekly samples for July 23-August 22, 1990





AUGUST WEATHER SUMMARY

HIGHLIGHTS: Stagnant weather systems early and late in August brought rainfall of 4 to over 12 inches along the **Atlantic Coast States.** Thunderstorms caused severe weather and heavy rains in much of the **Corn Belt** and parts of the **Great Plains.** At mid-August, swollen water levels from torrential downpours threatened to rupture dams on **Lakes Maniton and Tomah in northern Indiana.** On the 28th, tornadoes devastated **northern Illinois.** Hot, dry conditions prevailed across the **Delta** and **Southeast.** Temperatures were abnormally high in the **West** during the first half of the month, while a late-summer heat wave baked the **Central and Southern States** at month's end.

AUGUST 1-4: A frontal system edged eastward and drenched the central and southern Plains and Corn Belt with heavy rain. Hot weather returned to the Western United States, while unseasonably cool air remained over the Plains and Corn Belt.

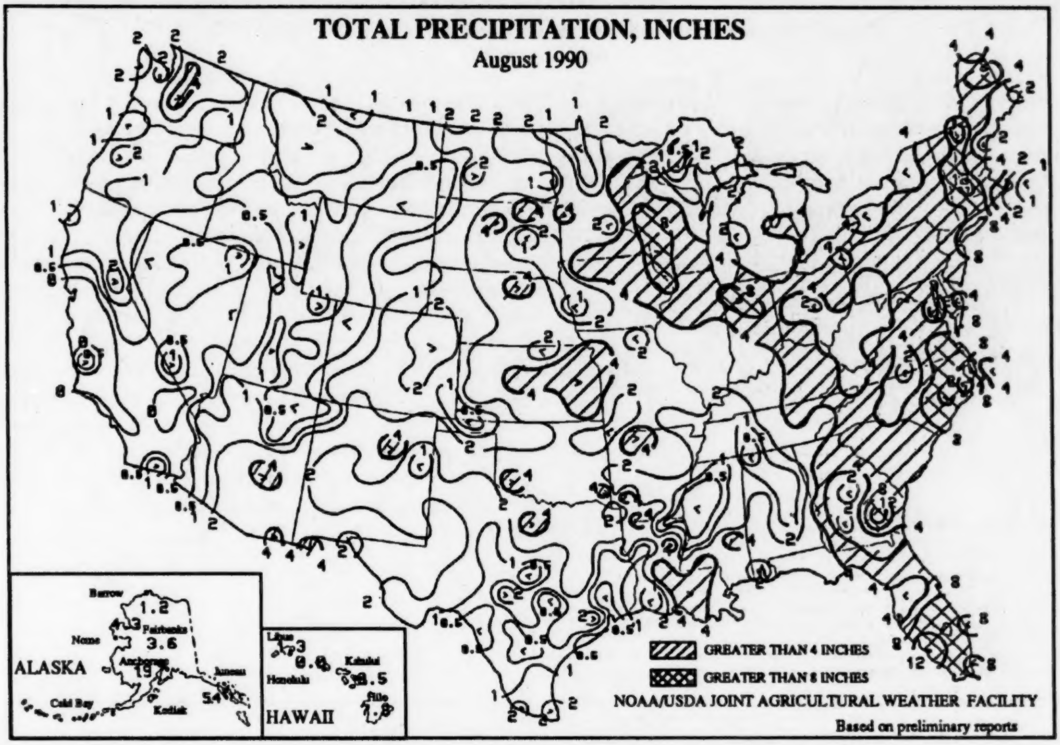
AUGUST 5-11: A stagnant weather pattern brought widespread showers and drenching rain to the Atlantic seaboard throughout the week. Steady rains soaked much of the Northeast and Middle Atlantic Coast States with 4 to over 8 inches. Strong thunderstorms again caused locally heavy rain and flooding from the central High Plains to southern Texas. Widespread showers reached from the northern Rockies into the Great Lakes and middle Mississippi Valley. The West remained unseasonably hot as temperatures soared into triple digits in the interior portions of the Pacific Coast States. Medford, Oregon, had 10 straight days of 100° F weather, while Sacramento, California, had a record seven straight days with a high of 105° F or above. In contrast, abnormally cool air remained over the central section of the Nation as numerous low temperature records for the date were set early in the week in the Plains and Mississippi Valley.

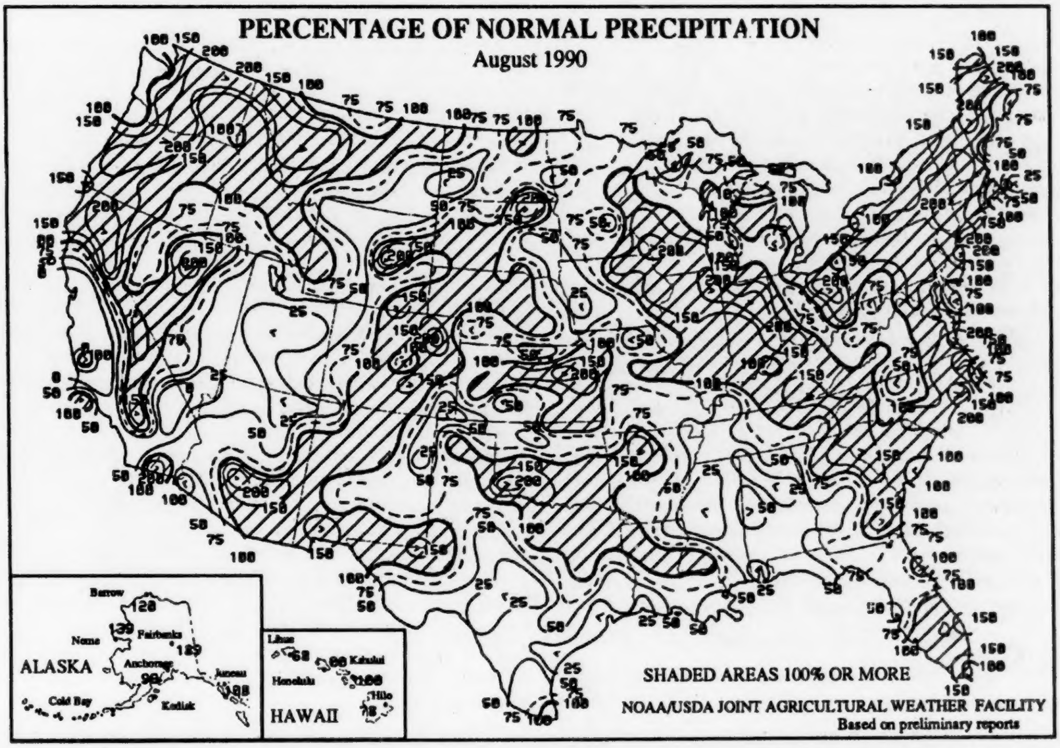
AUGUST 12-18: Showers and thunderstorms were widespread over much of the Nation, producing heavy rain and local flooding in the Southwest and Central and North Central States. Desert Hill, Arizona, near Phoenix, was deluged with 3.42 inches of rain in less than 2 hours on Tuesday morning. Rainfall of 5-7 inches was reported across northern Indiana late in the week. Dry weather prevailed across parts of the Gulf Coast States. Hot weather continued over the interior of the Northwest early in the week as temperatures again climbed into the hundreds. Relatively cool air remained over the Southwest, while record-high temperatures for the date were broken across the Southeast at week's end.

AUGUST 19-25: An upper level trough brought persistent overcast, rainy weather to much of the eastern seaboard. Rainfall in excess of 2 inches was common, with heavier rains (up to 13.5 inches) causing floods in several locations. Heavy rains were once again common across the Corn Belt, with over 4 inches reported in parts of Iowa and northern Illinois. Thunderstorms relieved dryness in the Gulf States, though high temperatures boosted evaporation rates. Maximum temperatures exceeded 100° F from Kansas southward to Texas and eastward to Alabama. Beneficial rain of 1-2 inches alleviated dryness in Montana and the Dakotas.

AUGUST 26-31: A late-summer heat wave baked much of the Nation as only the interior portions of the Pacific Coast States remained relatively cool. Temperatures soared into triple digits in the central and southern Great Plains and across the Southeast. Afternoon highs reached 108° F in central Kansas, where temperatures averaged 12° F above normal. Showers and thunderstorms were scattered over the eastern half of the country, the northern Pacific coast, and the Southwest, while dry conditions prevailed in the Great Plains. Thunderstorms spawned deadly tornadoes that struck Plainfield, Illinois and killed 29 people on the 28th. Intense thunderstorms continued to rake the Midwest, producing large hail, high wind, and heavy rain. Severe weather extended into the Atlantic Coast States and erupted across southern Texas at month's end.

(From W*eekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Facility)



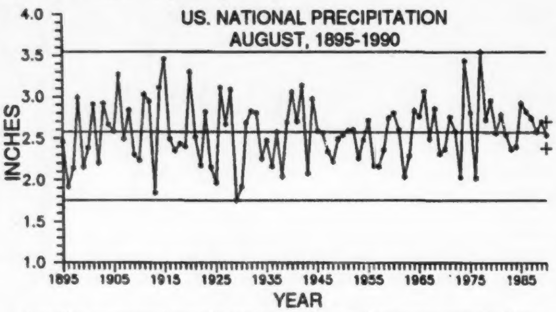


(From *Weekly Weather and Crop Bulletin* prepared and published by the NOAA/USDA Joint Agricultural Facility)

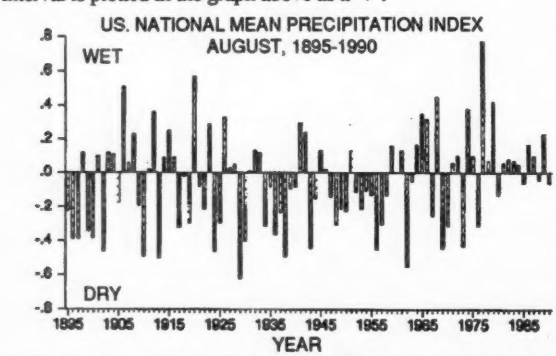
UNITED STATES AUGUST CLIMATE IN HISTORICAL PERSPECTIVE

(From Climate Perspectives Branch, Global Climate Lab, NCDC, NOAA)

Preliminary data for August 1990 indicate that temperature averaged across the contiguous United States was above the long-term mean. August 1990 ranks as the 29th warmest (68th coldest) August on record (the record begins in 1895). The 1990 value is based on preliminary data, which has been shown to be within 0.25° F of the final data over a 22-month period. This confidence interval is indicated in the figure by '+'.



Areally-averaged precipitation for the nation was near the long-term mean, ranking August 1990 as the 43rd driest (54th wettest) August on record. The preliminary value for precipitation is estimated to be accurate to within 0.16 inches and the confidence interval is plotted in the graph above as a '+'.

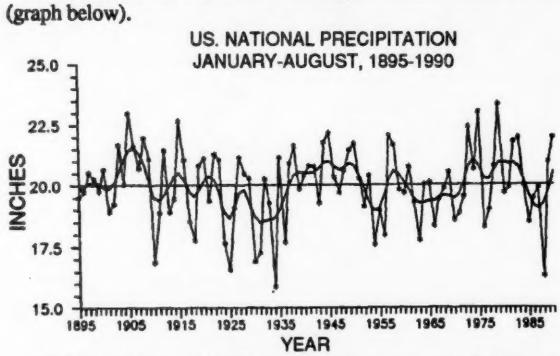


Historical precipitation is shown in a different way in the graph above. The August precipitation for each climate division in the country was first standardized using the gamma distribution over the 1951-80 period. These gamma-standardized values were then weighted by area and averaged to determine a national standardized precipitation value. Negative values are dry, positive are wetter than the mean. This index gives a more accurate indication of how precipitation across the country compares to the local normal climate. The areally-weighted mean standardized national precipitation ranks August 1990 as the 46th driest (51st wettest) August on record.

The combination of several cool air incursions and regional heat waves during the month brought nearly 100 daily record low temperatures and over 150 daily record high temperatures, according to the National Weather Service. This resulted in a variety of monthly average temperatures. Monthly precipitation also had considerable variability. The Northwest and Northeast regions were unusually wet, with the Northeast ranking as the seventh wettest August on record. The South and Southeast regions were in or near the dry third of the distribution, while the rest of the nation ranked in or near the middle third of the distribution.

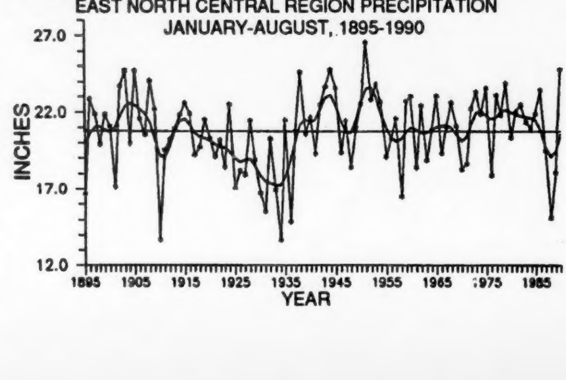
The overall national drought picture has changed little during the last year and a half. The percent of the country in severe to extreme long-term drought has fluctuated around 25 percent, while the percentage in the severely to extremely moist categories has ranged between roughly 5 and 15 percent. Only 13 other Augusts have had a larger drought area than August 1990. The basic change from last year at this time is a shift in the location of the moist area from the South and Southeast to the Midwest.

The year so far, for the nation as a whole, has been unusually warm. January-August mean temperature ranks 1990 as the fourth warmest January to August period on record. The January-August mean temperature for each of the last eight years has been at or above the long-term mean, rivaling the extremely hot 1930's. January-August 1990 ranks as the eighth wettest such period (graph below).



Thirteen states have had the tenth wettest, or wetter, January to August period on record in 1990, with Illinois ranking as the wettest on record. One state (South Carolina) has had a ranking in the tenth driest, or drier, category. Twenty-nine states have had the tenth warmest, or warmer, January to August period on record in 1990, with Delaware, Florida, Maryland, North Carolina, and South Carolina ranking as the warmest on record.

Persistently heavy rains in the Northeast, Central, East North Central, and South have given those regions January-August 1990 precipitation ranks of tenth wettest or wetter. The East North Central region has had the second wettest January-August on record (graph below). Only two years ago this region was experiencing conditions at the other extreme.



TEMPERATURE OUTLOOK FOR SEPTEMBER-NOVEMBER 1990

PRECIPITATION OUTLOOK FOR SEPTEMBER-NOVEMBER 1990

NATIONAL WATER CONDITIONS

AUGUST 1990

Based on reports from the Canadian and U.S. Field offices; completed September 17, 1990

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The National Water Conditions is published monthly. Subscriptions are free on application to the U.S. Geological Survey, 419 National Center, Reston, VA 22092.

EXPLANATION OF DATA (Revised December 1989)

Cover map shows generalized pattern of streamflow for the month based on provisional data from 186 index gaging stations—18 in Canada, 166 in the United States, and 2 in the Commonwealth of Puerto Rico. Alaska, Hawaii, and Puerto Rico inset maps show streamflow only at the index gaging stations that are located near the point shown by the arrows. Classifications on map are based on comparison of streamflow for the current month at each index station with the flow for the same month in the 30-year reference period, 1951-80. Shorter reference periods are used for one Canadian index station, two Kansas index stations, and the Puerto Rico index stations because of the limited records available.

The ***streamflow ranges map*** shows where streamflow has persisted in the above- or below-normal range from last month to this month and also where streamflow is in the above- or below-normal range this month after being in a different range last month. Three ***pie charts*** show: the percent of stations reporting discharges in each flow range for both the conterminous United States and southern Canada, and also the percent of area in each flow range for the conterminous United States and southern Canada. The ***bar graph*** shows total mean and total median flow for all reporting stations in the conterminous United States and southern Canada.

The comparative data are obtained by ranking the 30 flows for each month of the reference period in order of decreasing magnitude—the highest flow is given a ranking of 1 and the lowest flow is given a ranking of 30. Quartiles (25-percent points) are computed by averaging the 7th and 8th highest flows (upper quartile), 15th and 16th highest flows (middle quartile and median), and the 23rd and 24th highest flows (lower quartile). The upper and lower quartiles set off the highest and lowest 25 percent of flows, respectively, for the reference period. The median (middle quartile) is the middle value by definition. For the reference period, 50 percent of the flows are greater than the median, 50 percent are less than the median, 50 percent are between the upper and lower quartiles (in the normal range), 25 percent are greater than the upper quartile (above normal), and 25 percent are less than the lower quartile (below normal). Flow for the current month is then classified as: in the ***above-normal range*** if it is greater than the upper quartile, in the ***normal range*** if it is between the upper and lower quartiles, and in the ***below-normal range*** if it is less than the lower quartile. Change in flow from the previous month to the current month is classified as ***seasonal*** if the change is in the same direction as the change in the median. If the change is in the opposite direction of the change in the median, the change is classified as ***contraseasonal*** (opposite to the seasonal change). For example: at a particular index station, the January median is greater than the December median; if flow for the current January increased from December (the previous month), the increase is seasonal; if flow for the current January decreased from December, the decrease is contraseasonal.

Flood frequency analyses define the relation of flood peak magnitude to probability of occurrence or recurrence interval. ***Probability of occurrence*** is the chance that a given flood magnitude will be exceeded in any one year. ***Recurrence interval*** is the reciprocal of probability of occurrence and is the average number of years between occurrences. For example, a flood having a probability of occurrence of 0.01 (1 percent) has a recurrence interval of 100 years. ***Recurrence intervals imply no regularity of occurrence***; a 100-year flood might be exceeded in consecutive years or it might not be exceeded in a 100-year period.

Statements about ***ground-water levels*** refer to conditions near the end of the month. The water level in each key observation well is compared with average level for the end of the month determined from the 30-year reference period, 1951-80, or from the entire past record for that well when only limited records are available. Comparative data for ground-water levels are obtained in the same manner as comparative data for streamflow. ***Changes in ground-water levels***, unless described otherwise, are from the end of the previous month to the end of the current month.

Dissolved solids and temperature data are given for five stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). ***Dissolved solids*** are minerals dissolved in water and usually consist predominately of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. ***Dissolved-solids discharge*** represents the total daily amount of dissolved minerals carried by the stream. ***Dissolved-solids concentrations*** are generally higher during periods of low streamflow, but the highest dissolved-solids discharges occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

☆ U.S. Government Printing Office : 1990 - 262-087/20007

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